



Course Syllabus: Special Topics in Photonics - EE 390D

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	EE 390D
Course Title	Special Topics in Photonics
Academic Semester	Fall
Academic Year	2018/2019
Semester Start Date	08/26/2018
Semester End Date	12/11/2018
Class Schedule (Days & Time)	10:30 AM - 12:00 PM Mon Thu

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Kazuhiro Ohkawa	kazuhiro.ohkawa@kaust.edu.sa	+966128080701	2226, 3, Ibn Sina (bldg. 3)	Thursday 4-6pm. If you need other time slots, please send me an email.

Teaching Assistant(s)	
Name	Email

Course Information	
Comprehensive Course Description	New devices are often developed based on new materials. To realize new device structures and/or high-quality materials, growth technology is one of the key points to fulfill the inventors' ideas. It is important to understand physics and chemistry of crystal growth to develop new devices. The course deals with the essence of crystal growth, physical and chemical points of view of the phenomena, their device applications. This course is intended for Ph.D. students, but master students are welcome.
Course Description from Program Guide	
Goals and Objectives	Students are expected to acquire sufficient knowledge of semiconductor epitaxy and crystal growth for devices. Students will 1. know different type of crystal growth technologies 2. understand physics and chemistry of crystal growth 3. gain the knowledge of liquid-phase epitaxy, molecular beam epitaxy, and metalorganic vapor-phase epitaxy 4. learn binary and ternary alloys and their properties 5. learn growth of device structures by using different growth technologies.
Required Knowledge	Semiconductor fundamentals Basic of vacuum, inorganic chemistry, hydrodynamics, and molecular dynamics
Reference Texts	"Organometallic vapor-phase epitaxy" by Gerald B. Stringfellow, Academic press. "Semiconductor devices" by S. M. Sze and M. K. Lee, Wiley
Method of evaluation	20.00% - Written report 30.00% - Presentation 20.00% - Homework /Assignments 30.00% - Attendance and Participation

Nature of the assignments	Students must work independently on their report, presentation homework and other assignments.
Course Policies	Late homework and assignments will not be accepted.
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 08/27/2018 Thu 08/30/2018	Introduction of device structures, epitaxial technologies
2	Mon 09/03/2018 Thu 09/06/2018	Microscopic concept of growth mode
3	Mon 09/10/2018 Thu 09/13/2018	Si bulk and thin-film growth technologies
4	Mon 09/17/2018 Thu 09/20/2018	GaAs liquid-phase epitaxial growth Thermal problem in GaAs laser diodes
5	Mon 09/24/2018 Thu 09/27/2018	Physics of alloy compounds Optical gain in laser structure
6	Mon 10/01/2018 Thu 10/04/2018	Population inversion, optical confinement
7	Mon 10/08/2018 Thu 10/11/2018	Laser photon-electron interaction Self-sustained pulsation
8	Mon 10/15/2018 Thu 10/18/2018	Growth kinetics Surface observation
9	Mon 10/22/2018 Thu 10/25/2018	Mean free path of molecules GaAs molecular-beam epitaxy
10	Mon 10/29/2018 Thu 11/01/2018	Hole current in p-GaAs/p-AlGaInP junction p-InGaP interlayer to divide a large barrier
11	Mon 11/05/2018 Thu 11/08/2018	Surface migration Band diagram of pn junction
12	Mon 11/12/2018 Thu 11/15/2018	Introduction of metalorganic vapor phase epitaxy The principle of chemical vapor deposition
13	Mon 11/19/2018 Thu 11/22/2018	Gas flow Compressible viscous flow
14	Mon 11/26/2018 Thu 11/29/2018	Chemical reactions, collision diameter Chemical rate parameters
15	Mon 12/03/2018 Thu 12/06/2018	Thermal radiation and thermal contacts
16	Mon 12/10/2018	Presentation and report

Note

The instructor reserves the right to make changes to this syllabus as necessary.